December 3, 2013

MEMORANDUM TO: APLA Files

FROM: Hossein G. Hamzehee, Branch Chief **/RA/**
PRA Licensing Branch
Division of Risk Assessment
Office of Nuclear Reactor Regulation

SUBJECT: CLOSE-OUT OF FIRE PROBABILISTIC RISK ASSESSMENT FREQUENTLY ASKED QUESTION 13-0005 ON CABLE FIRES SPECIAL CASES: SELF-IGNITED AND CAUSED BY WELDING AND CUTTING

Background

During industry peer reviews and NRC review of Fire Probabilistic Risk Assessment (FPRA) applications to implement National Fire Protection Association "Performance-Based Standard for Fire Protection for Light-Water Reactor Electric Generating Plants" (NFPA 805), methods and approaches that were different from the accepted methods were encountered. U. S. Nuclear Regulatory Commission (NRC) staff collaborated with the Nuclear Energy Institute (NEI) and the nuclear industry to identify these methods, approaches, and factors in current FPRA applications (including but not limited to NFPA 805 applications) that are different from the NRC accepted methods, and to address them by providing clarification through a frequently asked question (FAQ) process. Other differing methods and approaches were also identified to be addressed outside the FAQ process by development of new methods through the Memorandum of Understanding between the Office of Nuclear Regulatory Research and Electric Power Research Institute.

Appendix R of NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities," dated September 2005, addresses self-ignited fires and fires caused by welding and cutting. Section R.1 presents a method to calculate the intensity of the initial fire based on an assumed burning area equal to the square of the tray width. However, the current fire events database contains no documented cases where self-ignited fires or fires caused by welding and cutting (i.e., hot work) have spread to engulf the area as recommended by the calculation methods in Section R.1 of NUREG/CR-6850. Furthermore, experimental measurements suggest that these types of fires are relatively small in nature and do not transfer enough heat to the surrounding cables to sustain flame spread and fire growth beyond the immediate vicinity of ignition. FPRA FAQ 13 0005, "Cable Fires Special Cases: Self-Ignited and Caused by Welding and Cutting," was proposed by the NRC to develop a more realistic approach for addressing self-ignited or hot work fires.

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Conclusion

Since November 2012, NRC staff and the nuclear industry have held a series of public meetings to discuss the resolution of FPRA FAQ 13-0005 along with other FPRA FAQs. Technical exchange between the NRC staff and the industry led to the resolution of this FAQ, which is documented in the Enclosure to this memorandum. The Enclosure provides a description of the issue, outlines a proposed approach for addressing self-ignited or hot work fires, and suggests replacement text for Section R.1 of NUREG/CR-6850.

The guidance in FPRA FAQ 13-0005 is acceptable for use by licensees. This guidance will be endorsed in the next revision to Regulatory Guide 1.205, “Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants.” The current method for evaluating cable fire risk identified in NUREG/CR-6850 remains as an acceptable method.

Enclosure:
As stated

Conclusion

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FAQ Number 13-0005 **FAQ Revision** 5

FAQ Title **Cable Fires Special Cases: Self Ignited and Caused by Welding and Cutting**

Plant: Various
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Purpose of FAQ:

The purpose of this FAQ is to provide additional guidance for detailed Fire PRA/Fire Modeling concerning self-ignited cable fires and cable fires caused by welding and cutting.

Relevant NRC document(s):
NUREG/CR-6850

Details:

NRC document needing interpretation (include document number and title, section, paragraph, and line numbers as applicable):

Appendix R of NUREG/CR-6850

Circumstances requiring interpretation or new guidance:

Appendix R of NUREG/CR-6850 (EPRI 1011989) addresses self-ignited fires and fires caused by welding and cutting in trays. Self-ignited cable fires should be postulated in rooms with unqualified cables[1] only or a mix of qualified and unqualified cables. Section R.1 presents a method to calculate the intensity of the initial fire based on an assumed burning area equal to the square of the tray width. However, the current fire events database contains no documented cases where self-ignited fires or fires caused by welding and cutting (i.e. hot work) have spread to engulf the area as recommended by the calculation methods in Section R.1. Furthermore, experimental measurements suggest that these types of fires are relatively small in nature and do not transfer enough heat to the surrounding cables to sustain flame spread and fire growth beyond the immediate vicinity of ignition.

This position paper outlines a more realistic approach for addressing these types of fire events and suggests replacement text for Section R.1. However, the current method of evaluating cable fire risk identified in NUREG/CR-6850 remains an acceptable method.

Detail contentious points if licensee and NRC have not reached consensus on the facts and circumstances:

None

[1] Throughout this white paper, the term “unqualified” indicates that the cable has failed to pass the vertical fire spread test specified in IEEE-383.

Potentially relevant existing FAQ numbers:

None.

Response Section:

1. Proposed resolution of FAQ and the basis for the proposal:

The EPRI Fire Events Database (FEDB) [1] was reviewed to find incidents of self-ignited cable fires and cable fires resulting from hot work. Also, past cable fire experiments, including the most recent CHRISTIFIRE Phase 1 study [2], were reviewed to identify data to improve the method outlined in NUREG/CR-6850. This methodology is only applicable to self-ignited cable fires and cable fires caused by welding and cutting, for all other cable fires see Appendix R of NUREG/CR-6850.

1.1 EPRI Fire Events Database / Industry Experience

The existing EPRI FEDB (i.e., the same version used in the development of NUREG/CR-6850) was reviewed for "Cable fires caused by welding and cutting." The search yielded 10 events. Seven of the 10 were determined to be "potentially challenging" according to the established criteria, all but one were reportedly very small fires with limited or no damage. Six of the fires deemed "potentially challenging" were manually suppressed. The one significant fire had a suppression time of approximately 30 minutes, but no indication of the extent of the damage was provided in the FEDB.

An additional search of the FEDB was made identifying events where the "Initiating Equipment" was related to "cable." This search yielded 47 events although one, as noted below, appears to be a duplicate record. Of these events, most of the self-ignited cable fires were reportedly caused by under-rated cables, overloaded trays, short circuits, and cable bunching or pinching. Out of these 47 events, 25 fires self-extinguished or ended when the power/fuel source was removed and damage was limited to the cable that initiated the fire.

The two earliest events (represented by records 2-4 in the FEDB[2]) warrant further discussion because of their significant duration. Both fires involved a specific set of 480 V power cables leading to pressurizer heaters inside containment at the San Onofre Nuclear Generating Station (SONGS), and they occurred approximately six weeks apart in 1968. These events were well documented and were the primary impetus for later revisions to the cable ampacity tables, cable ampacity calculation methods, and the addition of the flame spread test equipment to IEEE-383 (1974). The utility issued an extensive report on the incidents that included detailed event descriptions and root cause analysis [3]. These events predate the NRC fire protection regulations by over a decade, and at the time fire protection strategies were based on common industrial practices. In 1990, the NRC issued an instruction for providing a comprehensive inspection focused on electrical distribution systems at operating plants, entitled *Electrical Distribution System Functional Inspection* (EDSFI) [4]. The implementation of this process focused on identifying and correcting issues that would lead to this type of event.

[2] The full utility report on these incidents describes two fires, one on February 7, 1968 and the second on March 12, 1968. The FEDB indicates a third incident on March 9, 1968, but this appears to be a duplicate record because the description of the March 9 event indicates that the fire occurred in the exact cable trays listed in the utility report of the March 12 event.

Investigations showed that both fires resulted from excessive currents carried by a specific set of power cables. The incidents are summarized as follows:

- FEDB #2: On February 7, 1968, alarms were received in the MCR and a loud noise was heard in the plant at approximately 4:45AM. Responders immediately observed a fire in cables at a containment electrical penetration assembly head area. The fire was extinguished quickly. The full report indicates suppression within two minutes although the FEDB indicates a duration of 30 minutes. The fire occurred within the penetration head assembly and damaged all of the cables associated with that penetration but did not spread and did not cause damage to any other cables. The root cause analysis determined that the fire was caused by cable overheating which was in turn caused by a lack of air circulation within a weather protection cowl at the head of the electrical penetration assembly.

- FEDB #3 and #4 (these two records refer to the same event): On March 12, 1968, smoke was seen coming from a 480 V switchgear room. The detailed event timeline reports indications of electrical faults 5-10 minutes before smoke was seen. Plant personnel lacked the equipment needed to enter the smoke-filled room so firefighting support was requested from a nearby U.S. Marine Corp firefighting unit. The off-site firefighters arrived within approximately 20 minutes of detection but the pump on their fire truck failed to start, further delaying the initiation of suppression efforts. An alternate plant systems pump (an engine driven screen wash pump) was used to supply water and the fire was then extinguished within four minutes. Overall, the utility report indicates that the fire burned unchecked for at least 35 minutes and likely for closer to 45 minutes (versus the FEDB which indicates a total fire duration of 105 minutes). The fire damaged a substantial section of three stacked cable trays. The root cause analysis determined that the fire was caused by long term overheating and subsequent failure of the butyl insulation. The cables were rated for 32 amps but were carrying 45 amps.

The second incident was clearly the more severe of the two fires. Several factors associated with this event make it unique and changes to industry practices make a repeat event today unlikely:

1. The fire burned unchecked for an extended period (up to 45 minutes) because plant personnel were not equipped to fight such a fire and because the off-site fire brigade pumper failed to operate. Under current practices, the plant fire brigade is fully equipped and would be expected to initiate fire fighting for such a fire within 5-10 minutes at most. Redundant on-site fire pumps are also available at all sites.
2. The electrical protection scheme on the associated three-phase heater circuits used fusing such that only one phase cleared on initial faulting and the circuit continued to back-feed the faults through the heaters resulting in a continuous heating source over a substantial length within the tray. After the fire, these fuses were replaced with three-phase circuit breakers so that a similar situation would be prevented given a similar fault.
3. The plant had been operating with these cables in an overloaded condition for approximately one year prior to the fires and the cables likely suffered severe and premature aging degradation. Changes to ampacity limits as well as the EDSFI inspections prevent this situation in current applications.

4. The utility performed a cable tray thermal loading test to simulate the in-plant conditions prior to the fire and found cable temperatures as high as 158 °C (316 °F)[3] which is far in excess of the 90 °C (176 °F) cable insulation rating. This type of cable pre-heating will aggravate the subsequent fire behavior causing increased fire intensity and flame spread rates as demonstrated by testing in Germany[4]. Modern cable ampacity standards ensure that tray temperatures never exceed 90 °C (176 °F).
5. This event can be described as an "infant mortality" type fault that would certainly have been revealed if similar vulnerabilities existed at other members of the U.S. NPP fleet given their operating experience.

As a final note, the utility report states that "The fire was of such a limited nature that there was no overheating to the grating and beams or the air intake located 38 inches above the trays." It is assumed that this comment indicates that there was no observed deformation or discoloration of surrounding equipment. The fact that a relatively long section of cables was damaged (15 feet) suggests that the energy released per unit area was relatively small, inconsistent with a flaming fire. Had a flaming fire extended over 15 feet of the tray, visible damage would surely have been observed on the overhead grating and beams.

Overall, the March 1968 SONGS fire occurred early in the operating history of nuclear power generation. A repeat of this type of fire does not seem plausible given the many changes to plant electrical engineering practices and fire protection programs that resulted. Insights from these two SONGS cable fires led to significant reductions in cable ampacity limits for tray applications, restrictions on cable tray loading levels, and changes in common practice related to circuit protection. There have been no similar incidents at any U.S. nuclear power plant (NPP) to date. At most, such events have led to localized failures in a small number of cables within a single raceway. No event has led to sustained open flaming fires nor any damage to cables beyond the initially impacted raceway. More recent fire event data also support this conclusion. As a part of the NRC's audit of the recent EPRI FEDB update efforts, all of the newly identified events were reviewed by an NRC audit team. The review team paid particular attention to rare fire event types including various types of cable fires. The team did not encounter any events in the update set involving a significant self-ignited cable fire or hot-work related cable fire leading to failure of more than a small number of cables. This updated database will be evaluated further in greater detail when the updated EPRI FEDB is published.

Other than the SONGS event, there have been several ventilation-limited fire events at international facilities which warrant additional consideration when analyzing self-ignited cable fires. One such international event is summarized as follows.

On May 16, 2004, a cable fire occurred in a fire-resistant penetration carrying 6.6 kV electrical cables and other cables between the electrical building and the turbine hall. Other important safety-related cables were also routed through this penetration, including 380 V power supply

[3] Note that the utility report actually cites the cable temperature as 158 °F (70° C) (see page 5-7) and then states that this exceeds the cable rating of 90 °C (a very typical cable rating level). However, 158 °F equates to 70 °C which would not exceed the cable temperature rating. Also, the document consistently reports temperatures in °C with, apparently, this one exception. Overall, it appears clear that this one instance of °F is a typographical error and the measured temperature was actually 158 °C.

[4] See Section 2.2 for a discussion of the cable pre-heating fire experiments performed at the Braunschweig University for Technology in Germany.

cables for line protection equipment and turbine bypass system actuators. The fire was caused by overheating of the 6.6 kV cables powering the pumps circulating water to the condenser. These cables were undersized with a rated power of 9 MW. In addition, the cable penetration concerned was closed at both ends allowing a build-up of heat causing an “oven” effect and carbonization of the cables. The root cause was identified as the confinement of the cables in penetrations with two bulkheads as well as the sizing of the cables used to supply the pumps. The cumulative effect of these two conditions was the creation of a hot spot and an outbreak of fire at the opening to the penetration [5].

1.2 Fire Experiments

A review of previous fire experiments was conducted to identify information pertaining to ignition of electrical cables. The first experiments considered were those performed by the utility in the wake of the 1968 SONGS fires. The utility experiments reproduced the actual plant conditions including both the electrical and physical loading conditions. The cables were energized and preheated before fire testing to simulate the in-plant conditions. The tests also simulated the phase-to-phase short circuit and allowed for the power back-feed condition to persist as it did in the actual fire. Under these conditions, the utility was able to produce flaming combustion. However, more recent testing in Germany (discussed below) is relevant to the interpretation of these results and the original SONGS fire.

Among the fire experiments performed in the 1970s and 1980s at SNL and summarized in a 1989 document [6], two test series are of particular interest. The Electrically Initiated Cable Fire experiments, conducted in 1976, examined the potential for the development of self-ignited fire in qualified cables. It was found that currents in the range of 120-130 amperes were required to induce open flaming in the particular cables tested. These tests also reported that in full-scale experiments, “the intense period of fire activity persisted for between 40 and 240 seconds after which rapid reduction to self-extinguishment was observed.” None of these experiments involving qualified cables resulted in propagation of fire beyond the tray of origin. Consequently, the NUREG/CR-6850 methodology does not call for postulated self-ignited cable fires in qualified cabling.

In 1977, further experiments at SNL [7] determined that a minimum exposure time of five minutes is required to establish sustained combustion in a single cable tray. In this testing two IEEE-383-74 standard burners were used, each with an intensity of 20.5 kW. These experiments, although performed on qualified cables, suggest that a relatively small quantity of molten slag resulting from cutting or welding does not have the necessary heat capacity to sustain a minimum critical heat flux over a large enough area for a long enough period of time in comparison to a gas burner or liquid fuel fire that is typically used as an ignition source in cable fire experiments. Similarly, the relatively small flames resulting from a single over-heated cable cannot transfer enough heat to surrounding cables to propagate a substantial fire. In both the 1977 SNL experiments as well as the CHRISTIFIRE experiments [2], it was shown that a substantial external fire was necessary to ignite and sustain burning of cables within a single tray. In particular, CHRISTIFIRE Multiple Tray Test 13 demonstrated that a fire within a single tray containing unqualified thermoplastic cable does not radiate enough energy to the unburned portion of the cables within the tray to initiate spread beyond the point of origin. In this experiment, the fire was ignited from below using a 40 kW natural gas burner, and the fire did not spread beyond the area of direct flame impingement. These tests are intended only to illustrate that a substantial energy source is required to cause sustained ignition, not to provide minimum exposure HRR values to evaluate fire damage.

In recent years (2005-2007) the Braunschweig University for Technology assessed the impact of cable preheating on fire behavior [8]. Tests were performed with the cables at room temperature at the time of ignition and with the cables pre-heated to either 200 °C (390°F) or 400 °C (750°F) prior to ignition. They observed significant increases in both the peak fire heat release rate and the rate of fire spread for the preheated cables at both levels. For example, they report that flame spread rates were as much as 3.5 times faster given cable pre-heating. As noted above, the SONGS cable tray was preheated to as much as 158 °C (315°F) based on the electrical loading conditions and as verified during the tests. This is a condition that would not be possible given modern ampacity standards. This testing provides further evidence that the 1968 SONGS fire was an outlier case that would not be expected to be repeated today.

NUREG/CR-4527 [8] reports fire tests in NPP control cabinets. The purpose of these cabinet fire tests was to characterize the development and effects of internally ignited cabinet fires as a function of several parameters believed to most influence the burning process. Tests ST1 and ST2 with peak heat release rates of 24 kW and 27 kW, respectively, involved exposing a cable bundle to a transient ignition source. The electrical cabinet in these two tests contained qualified cables and were not ventilated. The report concluded that the ignition source was not intense enough to ignite and propagate a fire through the cable bundle. These results provide additional evidence that a substantial external fire is needed to sustain a propagating cable fire.

NUREG/CR-7010, CHRISTIFIRE [2], provides the results of small, intermediate and full-scale cable fire testing in horizontal trays. The results of the cone calorimeter experiments, where cables were exposed to 25 kW/m^2, indicated that ignition was achieved, but in many cases without sustained burning. The CHRISTIFIRE report goes on to assert that, “The cone calorimeter results suggest that the recommended ignition heat fluxes [in NUREG/CR-6850] might be too low to cause ignition and sustained burning of a group of electrical cables.” These results corroborate the early NRC/SNL tests above and illustrate that a substantial energy source is required to cause sustained ignition. Self-ignited cable fires and cable fires caused by welding and cutting do not generate the amount of sustained energy required to propagate fires proposed in the current NUREG-6850 methodology.

1.3 <u>Discussion</u>

Actual U.S. NPP fire experience includes more than 50 self-ignited and hot work-initiated cable fires. Of these fires, only the March 1968 SONGS fire led to a self-sustained cable fire with damage beyond a single raceway. In all other cases, these fires did not propagate beyond their ignition point, either because they self-extinguished or they were manually extinguished. The SONGS fire, as discussed previously, is considered an outlier. However, the current guidance in NUREG/CR-6850 – EPRI 1011989 is to assume that self-ignited or hot work-initiated fires readily spread over an area comparable to a square with dimension equal to the width of the tray. Taking the recommended heat release rate per unit area, this fire would extend upwards and ignite cables above. The process would repeat until the fire is assumed to have spread to the top of the array of trays. This postulated fire event is inconsistent with past experimentation and operating experience.

To address this inconsistency, a method is proposed below in which it is assumed that a self-ignited or hot work-initiated cable fire cannot damage cables beyond the raceway of origin. In essence, a tray containing multiple risk-significant cables would have a higher Conditional Core Damage Probability (CCDP) value and, based on the fire frequency allotted, would survive this screening process. The benefit of this procedure is that effort is not wasted carrying fire scenarios through the analysis that in reality would not result from these low-intensity ignition sources. The details of this process are provided in the proposed revised Section R.1 text.

2 Proposed Text for Section R.1

Two types of cable fires are described in Task 6 as part of the frequency model: self-ignited cable fires and cable fires caused by welding and cutting. Self-ignited cable fires should be postulated in rooms with unqualified cables only or a mix of qualified and unqualified cables.

These types of fires are typically small, initiated by a single failed cable, and grow slowly over time. In most cases documented in the fire events database, these fires do not generate enough heat to spread beyond the ignition point and usually self-extinguish. Typically, these fires damage only the initiator cable or at most the neighboring cables within the tray. In effect, this approach assumes that the zone of influence for these fires is equal to the tray of initiation only. This approach provides a method for screening and analysis of such fires without the need for detailed fire growth, damage and suppression modeling.

Fire frequencies for a compartment are estimated using the existing methods. For cable fires caused by welding and cutting, the transient weighting methods (see NUREG/CR-6850, Section 6.5.7.2[5]) should be used to estimate the compartment fire frequency for this ignition source. For self-ignited cable fires, a cable quantity ratio can be calculated by dividing the quantity of cable in the tray on fire by the total quantity of cable in the room. This ratio can be used to calculate the compartment fire frequency for this ignition source ($\lambda_{IS,J}$).

To illustrate this calculation, consider a hypothetical compartment with four cable raceways. The dimensions of the raceways and respective cable fill are given in Table R-0. The following example presents one method, based on a volumetric approach, for quantifying the ratio of cables in any particular tray over the quantity of cables in the compartment. The resulting cable volume ratio is then used to pro-rate the compartment fire frequency for this ignition source ($\lambda_{IS,J}$).

Table R-0 Dimensions of Cable Raceways for Cable Volume Ratio Calculation

Raceway Number	Length (m)	Width (m)	Depth (m)	Volume of Cable (m^3)	Volume Ratio
1	20 (65 ft)	0.6 (2ft)	0.015 (0.05ft)	0.180 (6.5 ft^3)	0.21
2	15 (50 ft)	0.6 (2ft)	0.030 (0.10ft)	0.270 (10 ft^3)	0.32
3	15 (50 ft)	0.6 (2ft)	0.015 (0.05ft)	0.135 (5 ft^3)	0.16
4	15 (50 ft)	0.6 (2ft)	0.030 (0.10ft)	0.270 (10 ft^3)	0.32

Once these frequencies are calculated for a given compartment, perform a screening process as follows.

[5] Section 6.7.5 received significant edits during the Chapter 6 revision

Step 1: Preliminary Analysis:

1. Identify all cable trays in the physical analysis unit that contain at least one fire PRA target cable. The remaining cable trays are screened out.
2. Calculate the CCDP values assuming the loss (failure) of one raceway at a time (i.e., there is never more than one raceway is involved, and there is no sequential fire propagation from one raceway to another). Repeat the calculation for each raceway and compile and sort the values in a table.

Step 2: First Screening Analysis:

1. Identify the tray with the largest CCDP value ($CCDP_{max,J}$) and estimate the CDF for the compartment as the product of the compartment fire frequency ($\lambda_{IS,J}$) and $CCPD_{max,J}$.
2. If this first screening level estimated CDF is low enough to meet PRA objectives, add this value to the compartment's total CDF and repeat this process for other compartments.
3. If the value is too large to meet PRA objective, conduct subsequent screenings as needed.

Step 3: Subsequent Screenings (optional):

1. Calculate the fire frequency applicable to the previously identified raceway (e.g., $\lambda_{Tray1,J}$) used to arrive at the $CCDP_{max,\,J}$ above. For self-ignited cables, use the cable volume ratio of the target tray to the total cable volume in the compartment. For cable fires caused by welding and cutting, use a compartment area ratio based on the plan view area of the target tray to the total area of trays in the compartment (i.e., assume a welding fire is equally likely over the surface area of all cable trays present).
2. Re-estimate a CDF value for the previously identified tray (with the largest CCDP) as the product of the tray-specific fire frequency ($\lambda_{Tray1,J}$) and $CCDP_{max,J}$.
3. Identify the tray with the second largest CCDP value ($CCDP_{Tray2,J}$), and calculate the CDF for the remainder of the compartment by assigning the remainder of the room frequency to that CCDP ($CDF = ((\lambda_{IS,J}-\lambda_{Tray1,J})xCCDP_{next,J})$.
4. The modified compartment CDF is then the sum of these two sub-cases.
5. Repeat the subsequent screening techniques as needed, working tray by tray down through the CCDP list, until PRA objectives are met or the analysis reaches the point of diminishing returns.
6. As an alternative, raceways may be grouped based on similar CCDP values and treated in groups rather than as individuals. That is, the CDF for a group of raceways can be estimated as the group's combined fire frequency times the highest individual CCDP value among the group (but do not compound the CCDPs).
7. It is recognized that some raceways will contain no fire PRA cable targets. For such raceways, if it can be confirmed that failure of cables in one or more raceways would not cause a plant transient then, consistent with other aspects of the general fire PRA methodology (e.g., qualitative screening[6]), those trays can be treated as a group having an effective CCDP value of 0.0 and, as such, non-contributors to fire-induced CDF.

[6] During qualitative screening, the fire PRA is not required to assume that all fires will inevitably lead to a plant trip provided the fire-induced failures in a compartment would not cause a plant transient. The approach here is intended to match that practice with respect to individual cable raceways that do not contain fire PRA target cables and whose failure would not represent a trip initiator.

This iterative process continues until very small numbers are calculated and the analysis can stop. In the end, the estimated CDF is simply the sum of those cases split out in detail plus the balance applied to the next worst tray in CCDP ranking table. Note that since the entire cable tray is assumed damaged upon initiation of the fire, no credit for suppression to prevent overall cable tray damage is allowed in this process.

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